Can sensory integration have a role in multi-element behavioural intervention? An evaluation of factors associated with the management of challenging behaviour in community adult learning disability services

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Title

Can sensory integration have a role in multi-element behavioural intervention? An evaluation of factors associated with the management of challenging behaviour in community adult learning disability services.

Abstract

Introduction

Adults with complex needs and severe learning disability, present as a serious management problem within the community. Restrictive interventions are often used to manage adults with these issues, even though best practice recommends the use of positive behaviour support. Positive behaviour support involves functional analysis but it does not specifically focus on sensory integration difficulties as a contributing factor to challenging behaviour.

Methods

A systematic search of the literature was completed using a range of electronic databases, an electronic search, hand search and review of reference lists. Seven relevant studies were identified. These studies were critically appraised and analysed. However, the extent of research was limited and the procedural quality variable, some distinct themes arose.

Results

Out of the seven intervention studies included in this review, two studies used sensory integration therapy, three employed multi-element behavioural intervention, one utilised environmental stimulation within a multi-factor behavioural intervention approach and one used sensory strategies within a structured behavioural intervention programme. The participants across the final seven papers reviewed consisted mainly of males with a high incidence of participants presenting with Autism. A range of assessment tools and outcome measures were used.

Conclusions

The use of restrictive intervention is still an issue in practice. Nearly all the studies reviewed stressed the issue of placing individuals with severe challenging behaviour in the community. Behavioural studies have successfully utilised sensory integration

strategies within a structured behavioural format to manage challenging behaviour in a community setting for adults with a learning disability.

Keywords: Autism, challenging behaviour, learning (intellectual) disabilities, community care.

Accessible summary

- Sensory integration strategies can be used successfully to help manage difficult behaviour.
- This is important as it could help reduce the use of restrictive intervention.

Introduction

Learning Disability (LD) refers to a wide group of neurological disorders. The term refers to a range including mild, moderate, severe and profound LD. LD originates before the age of eighteen. It is a condition characterised by significant limitations both in intellectual functioning and in adaptive behaviour as expressed in conceptual, social and practical adaptive skills. For example, someone who has a severe LD may present with little or no speech, will need support with daily tasks such as washing and dressing and will require lifelong support. Individuals with a severe LD are likely to display challenging behaviour (CB) (Matson & Boisjoli, 2009).

Challenging behaviour has been defined as culturally abnormal behaviour(s) of such intensity, frequency or duration that the physical safety of the person or others is likely to be placed in serious risk, or behaviour which is likely to seriously limit access to everyday community facilities (Emerson, 1995). Specific CB's include: aggression, destruction to property, self-injurious behaviour, withdrawal and non-compliance (Koritsas & Lacono, 2012). The cause of CB is still subject to debate. Matson & Boisjoli (2007), found that the majority of CB is sustained by multiple factors. This has been highlighted continuously (Brylewski & Wiggs, 1999, Taylor et al, 1993, O'Dwyer & Friedman, 1995, Matson & Neal, 2009, Bromley et al., 1998, Blickwedel et al., 2019, Chatterton 1998, Ayres, 1972).

The move from institutional care to the community proved successful for many individuals with mild to moderate LD (Joyce et al, 2001 & Felce et al.,1998). However, for those with complex needs and severe LD, balancing human rights and managing risk posed a serious management problem in the community (Perry et al. 2003) which required enhanced investment in staffing and accommodation infrastructure (Murphy, 2009, Bigby, 2012).

When assessing CB, a functional assessment is recommended as best practice (NICE, 2015). The complexity and intensity of the functional assessment is based according to the complexity and intensity of the behaviours. For those with severe CB, functional analysis is required (Lloyd & Kennedy, 2014). Not all individuals with a LD present with CB. Most studies report prevalence rates of CB among persons with LD between 10% and 20% (Myrbakk & von Tetzchner, 2008). Therefore, functional analysis of CB is required only for a small proportion of individuals with a LD, mainly those with a moderate to severe LD.

Management of CB

Restrictive Intervention such as physical restraint, mechanical restraint and seclusion are often used as behavioural support strategies for CB among people with a LD (Heyvaert et al., 2014). However, due to the ethical dilemmas (Wilkins, 2012) and potential risk of injury (Williams, 2009) their use is controversial (Jones & Stenfert Kroese, 2008). Lundstrom & colleagues (2011) assert the use of restraint is still an issue in practice. This would indicate there is a disparity between policy and practice in the management of CB (Feldman et al., 2004, Deveau & Mc Gill, 2009 & Rickard et al., 2013). As discussed by Webber et al. (2012) Restrictive intervention ought to be a least restrictive approach and should only be used as a last resort following preventative proactive strategies (Deveau and Mc Donnell, 2009). However, research into the management of CB in community adult learning disability services has been inconsistent (Romeo et al., 2009). The National Institute for Health and Care Excellence (NICE 2015) CB guidelines recommend the use of Positive Behaviour Support to manage CB in the community as positive behaviour support has been found to be a beneficial and cost-effective alternative compared to other established methods (LaVigna & Willis, 2012). Having said this, positive behaviour support teams can often have large caseloads and be under-resourced within the community.

Although positive behaviour support involves functional analysis it does not specifically focus on sensory dysfunction as a contributing factor to CB. For example, ‘escape from stimulation’ is hypothesed within positive behaviour support framework as having a ‘communication function’ whilst from a sensory integration perspective this could be viewed as escape from auditory, visual and/or tactile stimulus. Positive behaviour support incorporates multi-element intervention plans but the interventions appear to

focus on behavioural and communication strategies with a lack of acknowledgement for sensory integration strategies (Allen, 2009).

Review of literature

Learning Disability as a term is difficult to define within healthcare research as it is a complex issue used to describe a varied group of individuals (Sharfi & Rosenblum 2014). For example, individuals present with different levels of learning disability, it is associated with other disorders (Smith & Matson 2010) and some present with challenging behaviour. Due to the complexity of the issue and perceived difficulty with gaining consent for participation in studies there is emerging evidence to suggest that people with a LD and Autism are specifically excluded from healthcare research (Hamilton et al., 2016). In addition, the study of sensory integration (Watling & Hauer, 2015) is a new and developing area, which is also under-researched amongst adults with LD (May-Benson & Kinnealey, 2012). This highlights a specific need for research within this area.

Most sensory integration research in relation to adults has focused on adults with high-functioning Autism, most often using self-report questionnaires as opposed to sensory treatment (Brown et al., 2001 & Blanche et al., 2014). The majority of individuals with significant complex sensory needs display difficulties with communication and therefore the questionnaire may lack validity and reliability when used with this cohort. Furthermore, they may not be appropriate tools for cross sectional analysis within the population of people with learning disabilities.

Sensory and behavioural issues are often complex and can be intermixed. These difficulties are lifelong (May-Benson & Patane, 2010). It can be problematic to distinguish between sensory-based and non-sensory based CB as well as the impact of the environment on an individual's arousal levels, which too can lead to CB (Murray-Slutsky & Paris, 2005). For this reason, Occupational Therapists, Behaviour Therapists, Psychologists and Psychiatrists need to work together to improve services for those with CB.

There is a significantly limited amount of research on the use of sensory integration to manage CB for adults with a LD in the community as existing research is within an institutional setting and does not reflect the move to community practice (Brocklehurst-Wood, 1990, Clark et al., 1978, Close et al.,1986). Other adult sensory studies are on individuals with no LD (Engel-Yeger & Dunn, 2011, Kinnealey et al., 1995) and most of the community research focuses on children (Bagatell et al., 2015 & DuBois et al., 2017). Sensory integration difficulties are life-long and do not just affect children with a LD (Fanchiang's, 1996). Therefore, there is an obvious need to research the use of sensory integration on the management of CB for adults with a LD in the community.

Best practice in CB recommends a multi-element approach and use of positive behaviour support as a preventative strategy (MacDonald & Mc Gill, 2013). Thus, it is necessary to review the behavioural literature on multi-element behavioural intervention, focusing on sensory integration/ sensory environmental factors as preventative strategies to manage CB. The aim therefore of this review is to evaluate if sensory integration has a role in multi-element behavioural intervention in order to manage CB and reduce the potential need for restrictive interventions in the community for adults with a LD.

Methods

Inclusion criteria

English-language research reports published between 1995 and 2019 were identified according to the following criteria: (1) participants with a LD i.e. IQ below seventy and who display CB/ maladaptive behaviours, (2) participants were aged eighteen years and over, (3) lived in a community setting (4) study based on sensory (sensory integration, sensory strategies) or behavioural intervention (positive behaviour support) or using restrictive intervention as part of positive behaviour support (physical restraint, seclusion).

Exclusion criteria

Journals were excluded prior to the year 1995 due to the change in NHS service delivery at this time i.e. hospital to community care. An exception was the Tustin study (1994), as the participants in this study resided in supported living. Therefore, it reflects current community-based practice.

Excluded were (1) individuals who resided in an institutional setting (2) participants whose IQ is above seventy (3) who have a LD but did not display CB, (4) participants aged below eighteen years (5) studies on medication management, staff training and studies specific to communication (6) restrictive practice studies where the focus was on those with a mental health condition and/or forensic high security psychiatric patient and/or Dementia as opposed to LD, (7) those with a primary physical disability such as Cerebral Palsy or those with neurological condition such as brain injury, (8) individuals with a specific diagnosis where the condition is known to cause CB, for example, Lesch-nyhan syndrome as it is an inherited metabolic disorder that is characterised by self-mutilation, such as biting fingers and lips (Obi, 1997).

Literature search strategy

A systematic search of the literature using a range of electronic databases and included: PsychINFO, MEDLINE, AMED, CINAHL, BNI, Cochrane Library and Embase. A further electronic search was completed of nineteen specific journals known to publish research in relation to LD worldwide. Keywords used to search the databases and specific journals included “learning disability”, “mental retardation”, “challenging behaviour”, “restraint”, “environment”, “sensory” and “occupational therapy”. The title and abstract of each journal were read and the inclusion and exclusion criteria applied. The reference lists within studies were reviewed and a hand search was also completed. This resulted in seventy-two studies of which all full texts were obtained and read (Refer to Appendix 1. Table A1: Study screening process). Of these, forty-two were excluded, as these studies were based on personal, environmental, organisational factors and staff training. A further seventeen sensory studies were excluded based on the exclusion criteria. A total of thirteen studies were considered relevant to the review. However, following a comprehensive critique using specifically designed appraisal tools (Law et al.,1998 & Letts et al., 2007) a further six studies were excluded. When analysed further they did not meet the inclusion criteria, leaving seven studies in total (Refer to Appendix 2. Table A2: included intervention studies).

Ethical consideration

As this is a review of published studies, ethics was not pertinent as the studies have already attained ethical approval. There was no requirement for consent or to acquire personal information from participants.

Results

Seven studies in total met the inclusion criteria. Out of these intervention studies, two studies used sensory integration therapy (Green et al., 2003 & Urwin & Ballinger, 2005), three employed a multi-element behavioural intervention (Larue et al 2018, MacDonald et al., 2010 & McClean et al., 2007), one utilised environmental stimulation within a multi-factor behavioural intervention approach (Tustin, 1994) and one study used sensory strategies within a structured behavioural intervention programme (Blairs et al., 2007). Both sensory integration therapy studies completed the treatment across a four-week phase. The environmental and the sensory/ behavioural study both described treatment at six-month follow up, whilst in contrast, the behavioural intervention studies completed the treatment across a much longer time frame. McClean et al. (2007) reported on an eighteen-month treatment phase whilst MacDonald et al. (2010) had a twenty-two-month treatment phase. Most of the studies were carried out by or involved a Clinical Psychologist. Three of the studies involved an Occupational Therapist. Both sensory integration therapy studies involved Occupational Therapists and only one behavioural intervention study acknowledged Occupational Therapy. Only one study, the MacDonald et al. (2010) reported involvement from a Speech and Language Therapist (SLT).

Prior to the introduction of the intervention strategies, almost half of the studies (Blairs et al., 2007, Larue et al., 2018 & McClean et al., 2010) used reactive measures to manage the individuals. This included the use of seclusion, physical and chemical restraint. Only one study (Green et al., 2003) used behavioural intervention but the remaining studies (MacDonald et al., 2010, Tustin, 1994 and Urwin & Ballinger, 2005) did not detail how the clients were previously managed, leaving management strategies open to interpretation.

The study designs consisted of four case study designs, one of which was a retrospective study and the others were prospective in nature. One study was a ‘before and after design’ and two studies were single case experimental design. The majority

of the studies used quantitative data analysis except for Laure et al. (2018) which was a retrospective study that used a document review and focus groups to investigate the data and this makes it difficult to make comparisons with this study and the other studies.

The sample participants across the final seven papers reviewed consisted of twenty-seven participants in total, mainly of male gender (23:4). Not all studies provided complete data. However, based on the information that is detailed within studies the overall age ranged from twenty-one to fifty-five years of age. Of the twenty-seven participants, sixteen presented with Autism or Autistic traits. Diagnosis was not always detailed therefore this figure could potentially have been higher. In the same way, the level of LD was also not always detailed across the studies; twelve participants had an unknown level of LD. Having said that, the highest category was within the severe range of LD. In terms of CB the most frequent maladaptive behaviour described was aggression towards others with self-injurious behaviour and property destruction also ranking very high.

A range of assessment tools were employed which would be in keeping with the CB best practice guidelines, especially given the fact that the cohort are individuals with severe CB (NICE, 2015). In terms of functional assessment, the guidelines recommend in-depth assessment. This recommendation was generally followed by all the behavioural intervention studies which used functional assessment, apart from MacDonald et al. (2007). They did not carry out a document review and did not use functional analysis. However, they did complete the Motivation Assessment Scale (Durand & Crimmins, 1992) which is a recommended questionnaire within the NICE (2015) CB guidelines. The Tustin (1994) study also availed of the Motivation Assessment Scale in their study.

Out of all the prospective studies, Urwin & Ballinger (2005) was the only study that did not use formulation of hypothesis based on a range of observations. Instead, they used the Sensory Integration Inventory Revised (SII-R) (Reisman & Hanschu, 1992) to determine that the individuals had sensory modulation disorder. In addition, this was the only study that is not known to have completed direct observations of the participants prior to treatment. However, the relationship to the therapist prior to the

study is unknown asthey may have had previous Occupational Therapy assessments completed on record.

Both studies that carried out sensory integration therapy used video recordings and the SII-R (Reisman & Hanschu, 1992). They also both used the SII-R interpretation guideline developed by Chu and Green but they referenced two different years. One was the unpublished manual 1996 and the other 1998. This interpretation guideline was co-produced by Green, who is also one of the lead researchers in the Green et al. (2003) study, which could explain why they used the updated version in their study. Although Blairs et al. (2007) used sensory strategies within a behavioural programme they did not utilise any specific sensory or behavioural questionnaire. In addition, this study also did not quantify the frequency of the direct observations completed.

Antecedent, Behaviour and Consequence (ABC) charts were used by three studies, one of which was the Green et al. (2003) sensory integration therapy study. Unlike the other two behavioural studies, the sensory integration therapy intervention study used non-standardised ABC charts. This is likely because ABC charts are generally used as a behavioural method by Psychologists and Behavioural Therapists as opposed to Occupational therapists. A Psychologist was involved within the Green et al. (2003) study which may explain why they were used as part of their assessment.

Periodic Service Review was applied by both behavioural intervention studies. They too both used a severity rating scale to quantify the severity of the CB. MacDonald et al. (2010) used the CB Severity Rating Scale based on principles of episodic severity by La Vigna & Willis (2005) whilst McClean et al. (2007) used the Harris Challenging Behaviour Checklist (Harris, 1993). This checklist looks specifically at aggression. The La Vigna & Willis Rating Scale also looks at aggression but it rates the level of severity not over time but on average duration. This rating scale is more outcome focused making it practically easier to compare presentations.

The Tustin (1994) study used the Behaviour Disorder Scale (Tustin et al., 1991) to rate behaviours. This tool was established by the researcher which could be considered potentially biased as it may have been used for convenience. The McClean et al. (2007) study is unique in that they utilised a range of pre and post-test measures that were not incorporated by any of the other studies. Pre and post-test measures included the Quality of Life Questionnaire (Shalock et al., 1989), costing measures as

well as the Mini-PAS-ADD (Prosser et al., 1998) which assesses mental health problems in the LD population.

Outcome measures varied greatly across all the studies with some similarities. Blairs et al. (2007) & Larue et al. (2018) measured the use of restraint across time per month. Blairs et al. (2007) & McClean et al. (2007) both assessed the units of medication per month, whilst both sensory integration therapy studies used Goal Attainment Scaling within their research (Carr, 1979). MacDonald et al. (2010) & Urwin & Ballinger (2005) both evaluated the time spent engaged in activity whilst MacDonald et al. (2010) used score sheets to measure the percentage of time compared to Urwin & Ballinger (2005) which used time segments. Several studies calculated the frequency of target behaviours across time (Green et al., 2003, MacDonald et al., 2010, McClean et al., 2007 & Tustin, 1994). However, the method used to record differed across studies. Blairs et al. (2007) was distinct in that they were the only study to use physiological variables as an outcome measure.

Almost all the studies highlighted the difficulty of placing individuals with a LD and CB in the community. None of the participants remained within their family home, the majority had a change of environment. The highest placement category was clients being placed within an assessment and treatment unit and the second highest category was clients being placed within bespoke accommodation on their own. Significantly, Larue et al. (2018) highlights the issue of finding suitable accommodation for individuals with severe CB within the community.

All the studies resulted in an overall general decrease in CB except for one of the participants in the Green et al. (2003) sensory integration therapy study who did not show any meaningful change in presentation. The five of the seven studies that included behavioural intervention, successfully implemented a multi-element intervention approach with very positive results (Blairs et al., 2007, Larue et al., 2018, MacDonald et al., 2007 & McClean et al., 2007). Although, Tustin (1994) does not specifically incorporate a multi-element approach he has concluded in his findings that information should be gathered from multiple sources to best manage CB. Therefore, the results have clearly demonstrated that CB is best managed using a multi-element approach and that it is not based on a single factor. However, further analysis is

required to determine if sensory integration strategies were used within the multi-element interventions.

Discussion

Factors associated with the management of CB

Across the seven studies, the factors associated with the management of CB in adult LD services appears to be diverse and multi-element. The study population within this review demonstrated a number of potential personal risk factors such as, the sample population had varying levels of LD, the majority had limited communication skills, there was a high co-occurrence of LD with Autism. In addition, a high number resided within assessment units as well as residential care. Potentially then, they were at higher risk of being subject to restrictive practices based on organisational factors alone.

Sensory risk factors

Much of the CB research to date focuses on a range of personal, organisational and environmental factors that influence CB. Yet two sensory factors associated as predictors of CB were highlighted within these results. The first sensory factor was a preference for restraint and the second was sensory difficulties especially in relation to sensory over responsiveness in the tactile system. These two factors could potentially be related i.e. individuals eliciting restraint from their carers for positive gain. Blairs et al. (2007) reported that the participant was purposefully engaging in CB when restraint was removed. McClean et al. (2007) reported one individual to have engaged in head banging behaviours in order to seek attention from staff. However, it is not detailed if the theory of positive gain was explored in relation to this CB.

Blairs et al. (2007), not only describes the concept of physical gain but also the issue of sensory difficulties in relation to sensory over-responsiveness. The participant in this study demonstrated sensory over-responsive behaviours that could potentially have caused his CB. The participant's behaviours in MacDonald et al. (2010) are also

in keeping with an individual who is sensory over-responsive. As part of his multi-element behavioural intervention, he was trained to use a finish sign to communicate when he wanted people to leave him alone. Similarly, three of the five participants within McClean et al. (2007) were provided with escape communication training as part of a behavioural approach. It could be argued that these are self-regulation strategies to help individuals deal with being over-aroused by a chaotic sensory environment. In addition, none of the individuals in McClean et al. (2007) or MacDonald et al. (2010) are reported to have received a sensory integration assessment. Again, within the Tustin (1994) study one of the participant's behaviours was described as sensory over-responsive. In fact, the Motivation Assessment Scale (Durand & Crimmins, 1988) was carried out on both study participants and the sensory category was the highest score for both individuals. Yet, a sensory assessment was not referenced within the study. In conclusion, sensory integration strategies do appear to be used within multi-element behavioural intervention but are cited as behavioural rather than sensory integration strategies.

Ethics

Out of the seven studies reviewed, less than half of the studies discussed ethics or consent. Out of the three studies that discussed consent, one provided written consent by a carer along with inferred consent by the participant and the other two studies implied use of the best interest pathway. As a result, in order to ensure this population receive equitable health care, there needs to be a shift within research towards appropriate inclusion of adults who lack capacity.

Assessment

In terms of the cause of CB, a thorough assessment is required as it can often be difficult to decipher typically autistic behaviours from sensory behaviours. In Green et al. (2003) one of the participant's (Mr K's) perseverative tapping was initially hypothesised as a sensory reinforcer. The cause of the tapping was later determined to be due to noise but this was not acknowledged in the research until the treatment stage. The lack of ABC assessment charts for him meant that behaviours were based on direct observations. However, these observations were not quantified. Therefore, further in-depth sensory assessment and functional assessment would have been

warranted. This study is a prime example of the need for a behavioural and a sensory assessment to determine the cause of CB.

The cause of CB appears to be multi-element therefore it would seem best to consider the input of disciplines such as Occupational Therapy and Speech & Language Therapy at the early stages of assessment. Despite this, across the seven studies, Speech & Language Therapy was only mentioned once and Occupational Therapy was referenced in three studies. Sensory integration therapy is mainly used by Occupational Therapists although you do not have to be an Occupational Therapist to be trained in Sensory integration therapy. Hence within the behavioural studies, they have referenced sensory integration strategies that have mainly been carried out by Psychology services although there has been no indication of the individual's credentials in relation to completing sensory integration assessments, leaving the assessments open to interpretation.

There is a need to explore factors such as sensory integration factors that are not traditionally included in functional assessment. The benefits of the Motivation Assessment Scale have been highlighted within the studies in identifying sensory difficulties as risk factors (McClean et al., 2007 and MacDonald et al., 2010). MacDonald et al. (2010) highlighted escape to be the function of behaviours but it could be argued that the sensory environment had an impact on this individual. Although the Motivation Assessment Scale was completed, the scores of the assessment were not provided making it difficult to make comparisons. Having said this, the Motivation Assessment Scale could be a useful tool in helping guide Psychologists and Behavioural Therapists as to when an onward referral is required for a sensory integration assessment.

In relation to sensory integration assessment tools, both sensory studies utilised the SII-R (Reisman and Hanschu, 1992) along with the interpretation guideline. Within the limitations, both studies highlighted that this assessment was not sensitive enough. Alternative assessments that could have been considered include the Adult Sensory Profile (Dunn, 1999) and the Adult/ Adolescent Sensory History (May-Benson 2015) but both are self-report questionnaires and not valid for this cohort of individuals with severe CB and communication difficulties. Hence, there is an urgent need for standardised sensory integration assessments for adults with a LD.

Intervention

The intervention strategies referenced within all the behavioural studies were carried out in a structured format as opposed to being individual led. Despite this, it could be argued that many of the interventions involved sensory strategies; Tustin (1994) used a vibration chair, Blairs et al. (2007) wrapped the individual up in bedclothes and McClean et al. (2007) used a head massage. Overall, the results have demonstrated that behavioural studies have successfully used sensory integration strategies within a structured programme. Further research is required to compare provision of sensory integration strategies in a structured format versus clinic-based in reducing severe CB for adults with a LD.

Several sensory strategies were outlined by Larue et al. (2018) such as use of a weighted blanket. This study was led by Psychology services but the strategies described could be viewed as sensory strategies. Yet, within the study there was little reference made to the role of other multi-disciplinary team members as part of a multi-element approach. Therefore, provision of quantitative information in relation to other disciplines roles' would have been a useful outcome in terms of defining job roles, aiding service planning and to promote the benefit of having other disciplines involved within behaviour support services.

Studies differed on treatment time. The sensory integration therapy studies were completed over a four-week intervention period whilst in comparison the behavioural intervention studies were completed across a much longer time frame. This time frame ranged from six to twenty-two-months. From the studies it would seem that due to the nature of long-standing chronic behaviours that regular sensory integration input, over a longer intervention period, could be more beneficial for those with severe CB.

Green et al. (2003) and Urwin & Ballinger (2005) both used sensory integration therapy to treat maladaptive behaviours. Both sensory integration studies carried out individual led therapy but not all intervention therapists had access to sensory integration treatment clinics, which appeared to have an impact on the results. Urwin & Ballinger (2005) demonstrated sensory integration therapy to be effective for adults with a LD. In contrast, one of the participants in the Green et al. (2003) study did not demonstrate any change in CB. This participant had a pre-established daily routine and he received sensory integration therapy in addition to this routine. This change to schedule could

have had an impact on the outcome of the sensory integration therapy due to his diagnosis of Autism. Consequently, sensory integration therapy studies needed to be carried out over a longer period with treatment facilities that offer suitable sensory input in order to make valid comparisons.

The interventions in the studies presented with a number of flaws in relation to client and staff rapport, co-intervention and lack of information provided about the specific intervention or site. Client and staff rapport were not discussed as a potential contributing factor to intervention bias in a few of the studies, with the exception of the Tustin (1994) study. For example, in Blairs et al. (2007) a member of staff always remained with the participant during the intervention which could have had a positive effect on the results. In the Urwin & Ballinger (2005) study, participants three and five were both tactile defensive. Tactile defensiveness is often associated with an emotional response and it could be argued that the client-therapist rapport could have taken longer to establish with these individuals. A longer treatment phase would have been beneficial as it would have ruled this factor out. No information was provided in relation to the timing of the intervention or of the actual treatment clinic. Other factors such as the staff's handling strategies during personal care could have impacted the results. Handling strategies was an issue raised by staff within the Blairs et al. (2007) study. Therefore, staff's beliefs are a factor that could also have influenced the outcome of the results. In addition, the potential of co-intervention was generally not addressed by three of the seven studies. It would have been useful if MacDonald et al. (2010), Tustin (1994) & Urwin & Ballinger (2005) had outlined current medication, previous behavioural strategies tried or if restrictive practice was required at any stage in order to address the potential impact of co-intervention.

Environment

Across the seven studies, the majority had a change of placement with the highest number residing within an assessment and treatment in-patient unit or bespoke placement. McClean et al. (2007) reported that two individuals required the application of a low arousal environment. A change of environment was an outcome for the majority of individuals in this study. Therefore, a table demonstrating the change of environment, the type of environment and the level of staffing would have been useful

as this study demonstrates the potential success of bespoke placements within a community setting.

Communal settings are often associated with high arousal environments with noise and close social proximity. In the Green et al. (2003) and the MacDonald et al. (2010) study participants were over aroused by their sensory environment. These participants may have benefited from being brought to a low arousal environment such as a quiet room to test this theory. Creating environments in which individuals have predictability and control may reduce CB for those that are sensory over-responsive. However, there is a need for further research on the environment and sensory differences as current research is very limited in this area.

Outcomes

Outcomes across the studies varied. Blairs et al. (2007) used physiological variables. This study provided very little information on the physiological test methods therefore reducing confidence in the results. The participant (Mr B) had a diagnosis of Autism and enjoyed being tucked up in bed. As deep touch pressure was implemented as part of a structured programme it is not possible to identify it as a single factor in the reduction of his CB. For this reason, sleep may have been a useful quality of life measure to help support the use of deep touch pressure in the management of CB.

The use of physiological variables would have been helpful if used in the Green et al. (2003) study as they could have provided a more objective measure of the CB in relation to arousal levels. In this study Mr K's goals were based on the reduction of finger tapping whilst a more appropriate goal could have been his functional engagement in personal care. Both sensory integration therapy studies utilised Goal Attainment Scaling goals which are based on function (Carr 1979). However, Urwin & Ballinger (2005) did not detail the goals. Although, MacDonald et al. (2010) used a functional outcome, Goal Attainment Scaling goals may have been a more valid outcome measure as they could have measured the participant's progress in relation to accessing community activities again.

Conclusion

In conclusion, use of restrictive intervention is still an issue in community practice. Services are slowly beginning to incorporate primary preventative strategies such as

positive behaviour support to manage CB for adults with a LD. Positive behaviour support and multi-element intervention were used within all the behavioural studies with exceptionally positive results. Although positive behaviour support involves functional analysis, it does not specifically focus on sensory risks as a potential contributing factor to CB for adults with a LD.

Throughout all the studies, sensory integration strategies appeared to emerge within the multi-element behavioural interventions even though they were cited as behavioural approaches rather than sensory integration strategies. These studies were mainly carried out by Psychology services. However, from this review it is evident that it can be difficult to identify sensory based from non-sensory based CB. For this reason, the multi-disciplinary team needs to work together by expanding the functional assessment methods in order to improve services for those with CB. However, for professionals to work together, there is a need to establish standardised sensory integration assessments for adults with a LD that are not necessarily based on self-reporting. This review identified the Motivation Assessment Scale as a potential assessment tool that could be used to identify sensory risk factors and aid other disciplines in their decision as to when to refer on for a sensory integration assessment.

Nearly all the studies stressed the issue of placing individuals with a LD and severe CB in the community. Nevertheless, the implementation of individualised bespoke environments had a significant role in the management of individuals with severe CB. Notwithstanding, there is a need for future research on the sensory environment as a factor impacting on the management of adults with a LD and CB.

The interventions utilised presented with a range of limitations. Despite this, behavioural studies have successfully used sensory integration strategies within a structured behavioural format to manage CB in a community setting for adults with a LD. Recommendations for future research include the application of sensory integration over a longer period within multi-element behavioural interventions in order to quantify the role it plays in the management of adults with a LD and CB.

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APPENDIX 1. Table 1: Study screening process

Search details		
Screening process	**N**	**Number**
Initial database searching	N	100,457,938,864
Initial screen of titles: Excluded those on Dementia or elderly Psychiatry	N	2527
Title and abstract screened	N	800
Excluded as based on communication training, token system, staff training as opposed to treatment	N	160
Excluded as on children and adolescents not on Adults	N	107
Screened out based on deinstitutionalisation	N	85
Reference list	N	68 + 2
Hand search	N	70 +2
Studies reviewed further	N	72
Identified studies were read and categorised: Excluded as based on environmental factors (8): inpatient as opposed to community setting	N	64
Excluded as based on personal factors (16)	N	48
Excluded as based on organisational factors (8)	N	40
Excluded as based on staff training (10)	N	30
Excluded as based on sensory studies that did not meet inclusion criteria (17)	N	13
Excluded following use of critical appraisal tool (6)	N	**7**

Appendix 2. Table 2: Included Intervention Studies

No	Author & year	Intervention	Results
1.	Blairs et al, 2007	Proactive management Primary strategy Sensory strategy: Deep touch pressure	Deep pressure touch is demonstrated to have a beneficial effect on extreme agitation, including lowering increased heart rate and respiration, as well as reducing the need for physical restraint and medication.
2.	Green et al, 2003	Proactive management Primary strategy Sensory Integration Therapy	The results suggest that several individuals with a LD may have poor sensory processing influencing their behaviour. Following a trial period of SIT for two individuals, one client began to show observable and measurable improvements in interacting more effectively with her environment. The second client did not show any

			meaningful changes due to a number of factors.
3.	Larue et al, 2018	Proactive management Primary strategy Interventions that target the physical environment	Seclusion and restraint may be reduced through an evidence-based, multi factor approach. A combination of factors to include, organisational, clinical leadership, care-provider characteristics and evidenced based interventions (functional analysis and environmental changes).
4.	MacDonald et al, 2010	Proactive Management Primary Strategy Positive behaviour support plan to include Speech & Language Therapy	The implementation of positive behaviour support plan was associated with decreased challenging behaviour and increased participation inactivity for a man with severe learning disability and challenging behaviours.
5.	McClean et al, 2007	Proactive Management Primary Strategy Positive Behaviour Support Plans	The implementation of positive behaviour support plans was associated with substantial reductions in challenging behaviour for all five individuals. These findings question the levels of medication used with the four individuals and support a finding that medications can be successfully reduced and removed when appropriate behavioural interventions are introduced.
6.	Tustin, 1994	Proactive Management Primary Strategy Analysis of challenging behaviour.	Interventions were introduced for both clients, based on the hypothesis that one client may seek environmental stimulation, while the other client may avoid environmental stimulation.

		Intervention: Varying levels of environmental stimulation	Interventions were effective in both cases in reducing behaviours.
7.	Urwin & Ballinger, 2005	Proactive Management Primary Strategy Sensory Integration Therapy	The sensory integration therapy (SIT) intervention produced significant improvements in engagement for participant 4, with a highly significant deterioration in scores for all five participants on withdrawal of SIT. Five adults with moderate to severe learning disabilities had significant reductions in the duration of maladaptive behaviour with the introduction of SIT.

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